

PREPARATIONS OF THE RUSSIAN MISSION CONTROL CENTER FOR THE FINAL FLIGHT PHASE OF THE ORBITAL COMPLEX MIR

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About 20 years ago the Russian Mission Control Center (MCC, Korolev) was entrusted with the preparations and afterwards the flight control of the orbital complex (OC) MIR. During fifteen years the control had been carried out for 24 hours per day. During this period many critical situations were encountered when it seemed that the OC could not continue its work. But each time the MCC found the way out of the situation and the OC continued to perform the planned operations. The MCC did not commit any serious error which would have endangered the continuation of the flight program.

And, finally, the solution of the unique task of the OC deorbiting and splash down organization was a brilliant sequence of successful MCC activities. It confirmed the high scientific qualities and professionalism of the MCC specialists.

The task of the support of the OC final flight phase was so complicated that all the accumulated large potential and experience of the MCC staff were not enough for the completion of this job, without special preparations in all traditional and additional areas of the MCC activities (Tab. 1).

First of all, it was necessary to prepare all the technical means, to develop additional software and, in general, to prepare the MCC control personnel to carry out the final operations taking into account various possible non-nominal situations.

All operations had been performed in accordance with a specially developed plan in which all aspects of the MCC activities were reflected.

The activities with related organizations and establishing the interfaces with domestic and foreign partners had a particular place in the MCC preparations. The exceptional complexity of the task required to adopt a wide cooperation for its solution (Fig. 1). Practically all organizations which could contribute to solve the stated tasks were involved in the work. First of all, domestic and foreign organizations having the means for active or passive tracking of the OC. As the atmospheric parameters played a very important role during the final flight phase, also the leading organizations of the Russian Academy of Sciences and the State Committee of Meteorology were involved.

For the processing of incoming information and to improve the reliability of taking decisions, the back-up ballistic centers of the Academy of Sciences, the Defense Ministry and the main MIR designer were included as well. For coordination of all involved teams the organizing-technical documentation was developed, interfaces were defined, methods of interaction and information processing were determined, formats of results were standardized and so on.

To provide a complete understanding and to avoid errors during critical periods of work a special ballistic-navigational group was created. It consisted of leading specialists of all organizations taking part in the flight control. Moreover, a special control room was used (Fig. 2), which was equipped with all kinds of communication and visualization of various information including that received from onboard the OC.

A community informing about preparations and current work, about the status of onboard OC systems and plans of following work, about OC orbit parameters and so on took a very important place in MCC preparations and daily work. 64 daily ballistic bulletins with objective information on the OC flight were issued. This information and many other data were daily updated on the MCC Internet site.

During the preparations of the MCC for the final operations of the OC flight all the required precautions and reconditionings and also a number of special events for MCC infrastructure reliability improvement were performed.

It is difficult to describe the tension of the MCC control personnel during the final two days (22-23.03.2001). The public excitement was so great that the numerous MCC rooms could not accept all the persons who were eager to be at MCC. Really, besides the large team of specialists from all the organizations used for the control, various rank managers, main designers, directors of leading institutes, members of government and state commissions, for that period 60 foreign ambassadors, more than 600 journalists and a huge number of leading TV companies were present. All were provided with working places, they received in time the information from collective and individual visualization means and directly from leading specialists. As a result, they could correctly and timely inform the world community about current events.

The MCC solved excellently the stated unique task, it successfully managed all the difficulties and confirmed its high standard of flight control.

Finally, it should be especially noted that the MCC preparations for the final flight phase of the OC MIR had been performed in parallel with many other spacecraft control activities, such as the ISS, the Russian-Ukrainian spacecraft "Ocean O", Sea Launch, preparations for launch and control of the heavy spacecraft "Meteor 3M" and other work.

Tab. 1 MCC-M ACTIVITIES TO PREPARE THE MIR MISSION TERMINATION

Preparation of rooms, technical and communication means for flight dynamics and information support of Mir mission termination
Preparation of hardware and software of telemetry, command, flight dynamics, network, common and individual visualization means services.
Development of software for processing of all incoming measurements, including the non-traditional ones, in order to determine the Mir trajectory parameters.
Comprehensive testing of software and hardware applied in the flight dynamics support of Mir mission termination.
Coordination of Mir motion models and data on impact area prediction.
Development of interface, technology and formats to output measurement information and processing results (also from foreign sources) to MCC-M.
Training of operational interaction and data exchange with Space Surveillance Center and other information sources.
Consideration of possible non-nominal situations and development of measures to control them
Modification of operational and technical documentation taking into account Mir mission termination
Training of MCC-M and Main Operational Control Group for the Mir mission termination

ORGANIZATIONS AND SERVICES INVOLVED IN MIR STATION TRACKING BEFORE DEORBIT

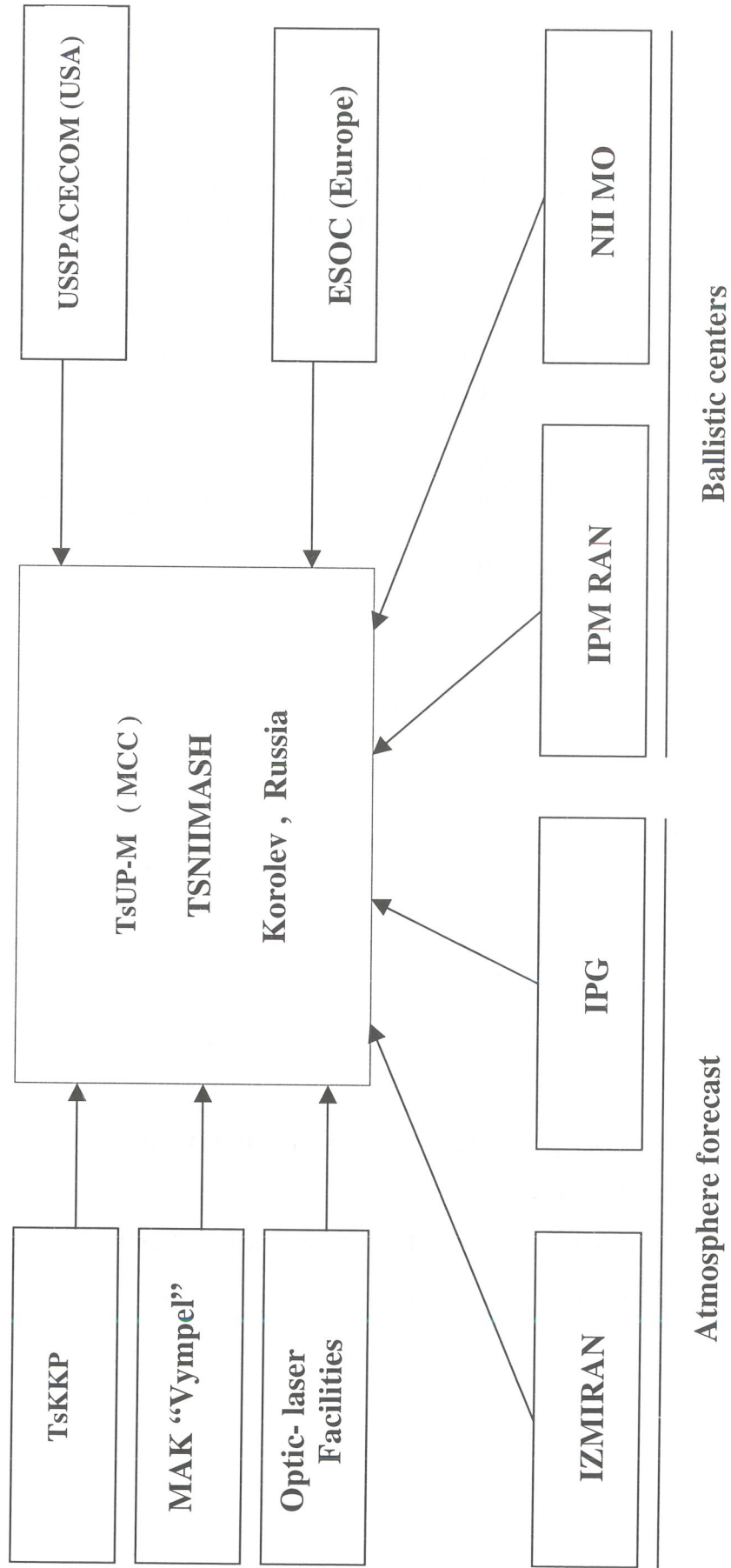


Fig. 1

CONTROL ROOM of Working Group 1 (WG-1) of Interagency Commission for organization and coordination of complex MIR flight final stage ballistic-navigational and informational support

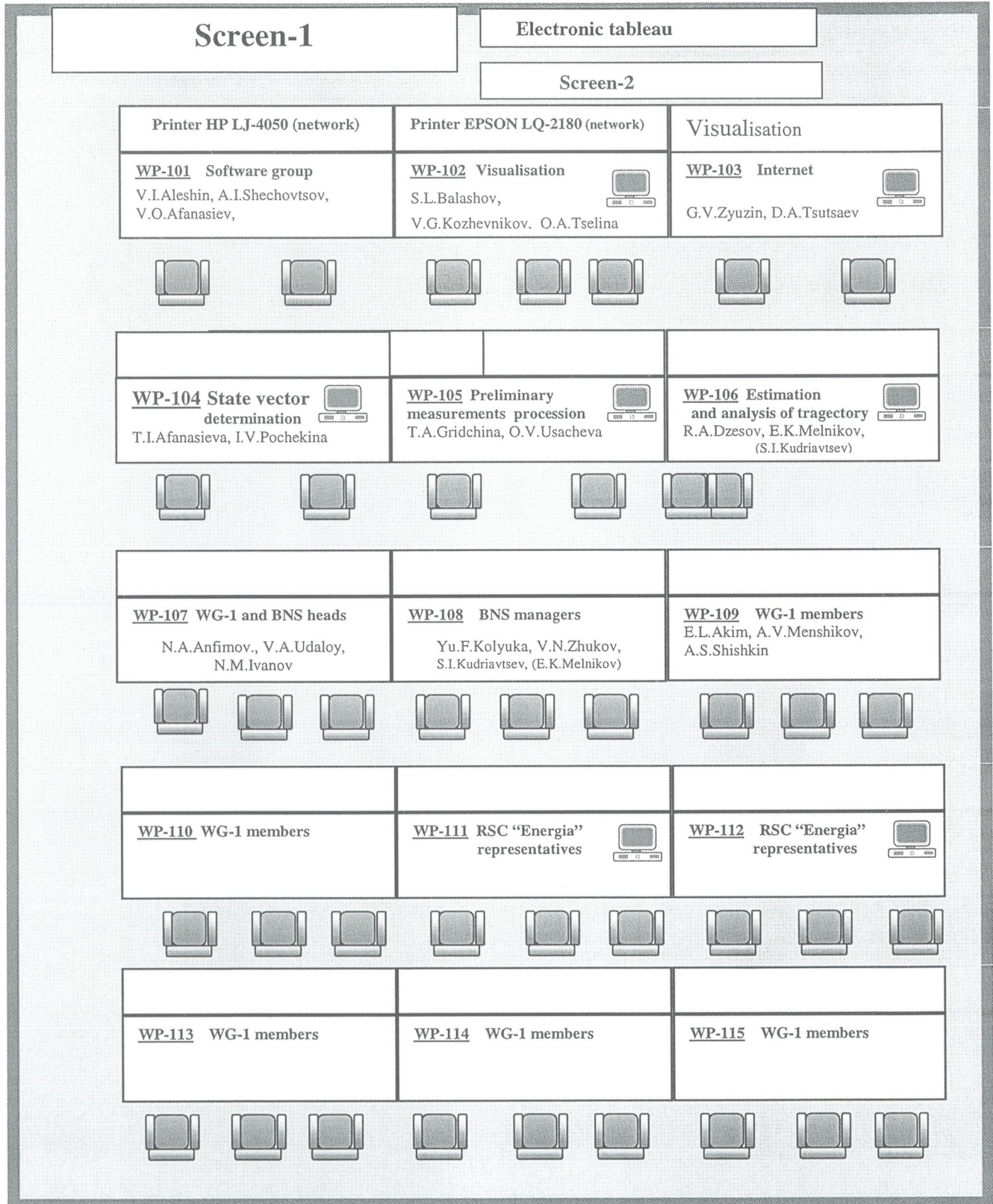


Fig. 2

